CDM Smith

**Memorandum**

*To:* *Andrea Adebowale, Director, Department of Water & Sewer Utilities, City of Newark*

*From:* *Sandy Kutzing, P.E., CDM Smith*

*Date:* *July 23, 2018*

*Subject:* *Sequential Sampling Program Protocol for Tracking Lead in Drinking Water*

The City of Newark will be conducting a Sequential Sampling Program starting August 2018. The purpose of this program is to identify potential sources of lead within the household plumbing and service connections at the sample locations. By sampling at various homes in Newark, the data can then be analyzed in a larger study to understand the sources of lead in drinking water and optimize corrosion control treatment. This sequential monitoring program consists of collecting the full volume of water between the kitchen faucet and the water main in small increments that allow for the isolation of water from various plumbing components, such as, but not limited to, fixtures, valves, pipe materials and meters. This memo provides the protocol to document the sequential sampling process.

## Sampling Program Overview

The sequential sampling program consists of two phases:

1. Site Audit
2. Sample Collection and Analysis

All site visits will be conducted by a minimum of three (3) people. A representative from the City of Newark will be present for the site audit visits and the sample collection visits. The site audit and sampling will be coordinated by CDM Smith with assistance from the City of Newark.

### *Phase 1 – Site Audit*

An initial visit to each home will be conducted to document the cold water piping, beginning at the faucet and traced back towards the water main in the street. Photographic documentation throughout the piping route will be taken for reference. This site visit can occur at any time of day and does not require any flushing or stagnation periods as no water samples will be collected. The following information is to be recorded for each plumbing segment:

Pipe Diameter

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Approximate Length of Pipe Segment (length of pipe between fittings, length of fitting or valve, etc.)

Pipe Material

Solder Material (to be confirmed with a lead swab test)

Type of Fixture (age, type of material, and whether or not there is an aerator)

Description (type of fitting or valve, bends, locations, valve, etc.)

Identification of Valves and Appurtenances (location within the line, type of material and size)

This information is recorded so the water volume can be calculated within each segment from the faucet to the main at each site. The sample volume will then be determined for sampling collection and analysis. The volume sample size will be the largest possible volume of water in a plumbing segment, without combining more than one lead feature. It is recommended that the sample size volumes be uniform sample volumes when conducting sequential sampling, but there may be unique circumstances that need to include different sample sizes as well. Table 1 is provided as an example of a site audit form.

*Phase 2 – Sample Collection and Analysis*

Sequential sampling is conducted after a stagnation period, between 6 to 12 hours, per the Lead and Copper Rule requirements. The line must be flushed by running all indoor and outdoor faucets with cold water for 10 minutes prior to the stagnation period. It is recommended that the line be flushed the morning of the scheduled sampling by the resident. The stagnation period would be during the day. The technicians would perform the sampling at the end of the day when the resident returns from work, prior to any water usage. If there are other residents in the home during the day, the flushing would need to occur in the evening and the technicians would perform the sampling first thing in the morning. Handheld analytical equipment for on-site testing (pH, temperature, free chlorine) will be provided by the City of Newark.

Samples will be taken at the kitchen sink. Aerators are to remain while sampling and flushing and only cold water should be used. The following information is to be recorded during the sampling procedure on Table 2 (attached):

Date and time of 10 minute flush (before stagnation)

Duration of stagnation period

Date and time of sampling (after stagnation period)

Name of individual that collected the post stagnation samples

Date and time of flush (after sampling)

Name of individual that collected the flush sample

Flowrate (after sampling)

Water softener presence

Aerator presence

Each sample is provided a unique name (ie: 1S, 2S, 3S, etc.) and bottles will be labeled prior to the samples taken with waterproof labels and sharpie pen. The samples are to be taken at the kitchen faucet continuously by running the cold water tap at a flowrate that would typically be used by the residents to fill a glass of water. It is critical to keep the flow continuous and at a constant flowrate to avoid disrupting insoluble lead particles on the pipe walls. The following parameters are to be tested for each sample:

pH (first sample and flushed final sample measured in the field)

Temperature (first sample and flushed final sample measured in the field)

Free chlorine (first sample and flushed final sample measured in the field)

Total Lead

Dissolved Lead

Total Copper

Silica Residual ($SiO_2$) (first sample and flushed final sample)

Alkalinity (first sample and flushed final sample)

Conductivity (first sample and flushed final sample)

The parameters measured in the field must be performed within 10 minutes of taking the sample. After completing the amount of samples needed per site audit review, the water line is to be flushed for 10 minutes at the same flowrate as the test. The flowrate will be calculated during this time. A final sample of 1000 mL (flushed final sample) is to then be collected. All analytical results will be summarized in Table 3 (attached) and a profile will be developed showing lead and copper results relative to plumbing features in the home plumbing.

*Sample Locations*

The following addresses are proposed to be sampled for the City of Newark's sequential sampling study. Each home is suspected as having both a lead service line and lead solder with copper indoor plumbing.

Personal Matters / Ex. 6 Newark, NJ 07104 (North Ward)

Personal Matters / Ex. 6 Newark, NJ 07106 (West Ward)

Personal Matters / Ex. 6 Newark, NJ 07112 (South Ward)

Personal Matters / Ex. 6 Newark, NJ 07108 (South Ward)

A location map of the addresses is provided in Figure 1 attached.

*Laboratory Testing and Results*

The laboratory performing the testing will provide the required sample bottles. The number of bottles required will be determined after the site audit. Once the samples are collected, CDM Smith will be package and ship to the laboratory. Results are anticipated within 10 business days.

Once the results are received from the laboratory, a lead profile will be plotted for each home and compared with the locations of the lead components determined from the site audit. After optimized corrosion control treatment is implemented, the sampling is recommended to be repeated on a monthly basis to track the progression of the treatment and until lead levels stabilize.

cc: K. Adeem, Newark
M. Ahmed, Newark
M. Athar, Newark
J. George, Newark
S. Samuel, Newark
P. Hogan, CDM Smith
C. Rego, CDM Smith
D. Smith, CDM Smith

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Table 1

City of Newark Sequential Monitoring

Sample Address:_____

Site Audit Notes

| Plumbing Segment | Diameter (in) | Length (in) | Material | Solder Material | Type of Fixture (age, aerator, etc.) | Location/Description/Notes |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
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| 11 | | | | | | |
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| 13 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |
| 16 | | | | | | |
| 17 | | | | | | |
| 18 | | | | | | |
| 19 | | | | | | |
| 20 | | | | | | |

Table 1

City of Newark Sequential Monitoring

Sample Address:_____

Site Audit Notes

| | | | | | | |
|---|---|---|---|---|---|---|
| 21 | | | | | | |
| 22 | | | | | | |
| 23 | | | | | | |
| 24 | | | | | | |
| 25 | | | | | | |
| 26 | | | | | | |
| 27 | | | | | | |
| 28 | | | | | | |
| 29 | | | | | | |
| 30 | | | | | | |
| 31 | | | | | | |
| 32 | | | | | | |
| 33 | | | | | | |
| 34 | | | | | | |
| 35 | | | | | | |
| 36 | | | | | | |
| 37 | | | | | | |
| 38 | | | | | | |
| 39 | | | | | | |
| 40 | | | | | | |
| 41 | | | | | | |

Table 1

City of Newark Sequential Monitoring

Sample Address:_____

Site Audit Notes

| | | | | | | |
|---|---|---|---|---|---|---|
| **42** | | | | | | |
| **43** | | | | | | |
| **44** | | | | | | |
| **45** | | | | | | |
| **46** | | | | | | |
| **47** | | | | | | |
| **48** | | | | | | |
| **49** | | | | | | |
| **50** | | | | | | |
| **51** | | | | | | |
| **52** | | | | | | |
| **53** | | | | | | |
| **54** | | | | | | |
| **55** | | | | | | |
| **56** | | | | | | |
| **57** | | | | | | |
| **58** | | | | | | |
| **59** | | | | | | |
| **60** | | | | | | |
| **61** | | | | | | |
| **62** | | | | | | |

Table 1

City of Newark Sequential Monitoring

Sample Address:_____

Site Audit Notes

| | | | | | | |
|---|---|---|---|---|---|---|
| **63** | | | | | | |
| **64** | | | | | | |
| **65** | | | | | | |

Table 2

City of Newark Sequential Monitoring

Sample Address:_____

Field Notes

| Sample | Volume | Cumulative Volume | Collection | Water Quality Parameters | | | Location/Notes |
|---|---|---|---|---|---|---|---|
| | (mL) | (mL) | | pH | Temp | Free $Cl_2$ | |
| | | | | | (degrees C) | (mg/L) | |
| 1S | | | After Stagnation | | | | |
| 1F | | | Flushed after the sequential sampling | | | | |

DATE AND TIME OF 10 MINUTE FLUSH (before stagnation) DATE _____ TIME _____

DURATION OF STAGNATION PERIOD: _____

DATE AND TIME OF SAMPLE (after stagnation period) DATE _____ TIME _____

POST STAGNATION SAMPLES COLLECTED BY: _____

DATE AND TIME OF FLUSH (after sampling) DATE _____ TIME _____

FLUSH SAMPLE COLLECTED BY: _____

FLOWRATE MEASURED (gpm): _____

IS THERE A WATER SOFTENER? _____

IS THERE AN AERATOR ON THE FAUCET TESTED? _____

COMMENTS/NOTES: _____

_____

_____

_____

_____

Table 3

City of Newark Sequential Monitoring

Sample Address:_____

Analytical Results

| Sample | Volume (mL) | Cumulative Volume (mL) | Collection | Water Quality Parameters | | | | | | | | | Location |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pH[1] | Temp[1] (degrees C) | Free $Cl_2$[1] (mg/L) | Total Pb (mg/L) | Dissolved Pb (mg/L) | Total Cu (mg/L) | Silica (mg/L) | Alk. (mg/L as $CaCO_3$) | Cond. umhos/cm | |
| 1 | 250 | 250 | After Stagnation | | | | | | | | | | Faucet |
| 2 | 250 | 500 | After Stagnation | | | | | | | | | | |
| 3 | 250 | 750 | After Stagnation | | | | | | | | | | Lead Pipe |
| 4 | 250 | 1000 | After Stagnation | | | | | | | | | | |
| 5 | 250 | 1250 | After Stagnation | | | | | | | | | | brass valve |
| 6 | 250 | 1500 | After Stagnation | | | | | | | | | | brass pipe and valve |
| 7 | 250 | 1750 | After Stagnation | | | | | | | | | | brass pipe (lg dia.) |
| 8 | 250 | 2000 | After Stagnation | | | | | | | | | | brass pipe (lg dia.) |
| 9 | 250 | 2250 | After Stagnation | | | | | | | | | | |
| 10 | 250 | 2500 | After Stagnation | | | | | | | | | | |
| 11 | 250 | 2750 | After Stagnation | | | | | | | | | | |
| 12 | 250 | 3000 | After Stagnation | | | | | | | | | | |
| 13 | 250 | 3250 | After Stagnation | | | | | | | | | | |
| 14 | 250 | 3500 | After Stagnation | | | | | | | | | | |
| 15 | 250 | 3750 | After Stagnation | | | | | | | | | | |
| 16 | 250 | 4000 | After Stagnation | | | | | | | | | | |
| 17 | 250 | 4250 | After Stagnation | | | | | | | | | | |
| 18 | 250 | 4500 | After Stagnation | | | | | | | | | | |
| 19 | 250 | 4750 | After Stagnation | | | | | | | | | | |
| 20 | 250 | 5000 | After Stagnation | | | | | | | | | | |

Table 3

City of Newark Sequential Monitoring

Sample Address:_____

Analytical Results

| Sample | Volume (mL) | Cumulative Volume (mL) | Collection | Water Quality Parameters | | | | | | | | | Location |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pH[1] | Temp[1] (degrees C) | Free $Cl_2$[1] (mg/L) | Total Pb (mg/L) | Dissolved Pb (mg/L) | Total Cu (mg/L) | Silica (mg/L) | Alk. (mg/L as $CaCO_3$) | Cond. umhos/cm | |
| 21 | 250 | 5250 | After Stagnation | | | | | | | | | | |
| 22 | 250 | 5500 | After Stagnation | | | | | | | | | | |
| 23 | 250 | 5750 | After Stagnation | | | | | | | | | | |
| 24 | 250 | 6000 | After Stagnation | | | | | | | | | | |
| 25 | 250 | 6250 | After Stagnation | | | | | | | | | | |
| 26 | 250 | 6500 | After Stagnation | | | | | | | | | | |
| 27 | 250 | 6750 | After Stagnation | | | | | | | | | | |
| 28 | 250 | 7000 | After Stagnation | | | | | | | | | | |
| 29 | 250 | 7250 | After Stagnation | | | | | | | | | | |
| 30 | 250 | 7500 | After Stagnation | | | | | | | | | | |
| 31 | 250 | 7750 | After Stagnation | | | | | | | | | | |
| 32 | 250 | 8000 | After Stagnation | | | | | | | | | | |
| 33 | 250 | 8250 | After Stagnation | | | | | | | | | | brass pipe (lg dia.) |
| 34 | 250 | 8500 | After Stagnation | | | | | | | | | | brass pipe (sm dia.) |
| 35 | 250 | 8750 | After Stagnation | | | | | | | | | | meter |
| 36 | 250 | 9000 | After Stagnation | | | | | | | | | | meter/LSL |
| 37 | 250 | 9250 | After Stagnation | | | | | | | | | | LSL |
| 38 | 250 | 9500 | After Stagnation | | | | | | | | | | Cu Service |
| 39 | 250 | 9750 | After Stagnation | | | | | | | | | | |
| 40 | 250 | 10000 | After Stagnation | | | | | | | | | | |

Table 3

City of Newark Sequential Monitoring

Sample Address:_____

Analytical Results

| Sample | Volume (mL) | Cumulative Volume (mL) | Collection | Water Quality Parameters | | | | | | | | | Location |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pH[1] | Temp[1] | Free $Cl_2$[1] | Total Pb | Dissolved Pb | Total Cu | Silica | Alk. | Cond. | |
| | | | | | (degrees C) | (mg/L) | (mg/L) | (mg/L) | (mg/L) | (mg/L) | (mg/L as $CaCO_3$) | umhos/cm | |
| 1F | 1000 | 11000 | Flushed after the sequential sampling | | | | | | | | | | |

NOTES

1. pH, temperature, and free chlorine will be field measured.
2. **HOMEOWNER SHOULD FLUSH THE LINE FOR 10 MINUTES BEFORE BEGINNING STAGNATION PERIOD (i.e. night before sampling).**
   **TIME OF FLUSH / START OF STAGNATION PERIOD SHOULD BE RECORDED**

# Figure 1 - Lead Sampling Location Map